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ABSTRACT

The Environmental Education Project Center has developed these guidelines for teaching a unit in environmental studies. It is their intention that the teacher and student cooperatively plan the approach and content to be used during the course of study. In this unit about water, teacher resource information and student material are combined to form a teacher's manual for use in the intermediate grade levels. Project objectives, behavioral objectives, and pre- and post-test questions introduce the unit sections followed by ideas, actions, and/or activities to develop awareness of water qualities and pollution effects. Major topics of discussion range from uses of water, farmlot drainage, and watershed litter to the effects of sewage on streams and treating wastewater. Field trips emphasizing concepts previously learned are suggested and additional sources of information and materials for both students and teachers are listed. This work was prepared under an ESEA Title III contract for the project "Operation Survival Through Environmental Education." (BL)

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ENVIRONMENT

INTERMEDIATE
Idea 3
Water

TEACHER MANUAL

Title III
ESEA

"Operation Survival Through
Environmental Education"

Environmental Education Project

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ENVIRONMENTAL IDEAS

FOR THE STUDENT

-Water-

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I N T R O D U C T I O N

to

ENVIRONMENT Idea 3 Water

INTERMEDIATE RESOURCE UNIT

The Title III, Environmental Education Project Center is providing your class with the following materials to teach a unit on water.

Student Manuals - 1 per student
Teacher Manual - 1
Supplementary Materials (as requested by the classroom teacher)

It is the project's intention to provide guidelines for the teacher and student to cooperatively plan the approach and content to be used during the course of study. All or part of the material can be used after evaluating the needs of the students.

The Environmental Education Project is evaluated by meeting objectives as outlined in the original project proposal. The resource units are written to meet these project objectives with additional material deemed necessary by the project staff, area teachers and administrators, and local environmental concerns.

A summary of the project objectives is provided to inform you of the areas being evaluated concerning the water unit. When using the curriculum materials, we urge you to teach toward these objectives.

- decrease in the number of drains from farmyard lots into drainage ditches and small streams
- decrease in the number of incidents of raw sewage drained into streams
- decrease in use of pesticides in the homes, the gardens, and the fields
- decrease in the number of pounds of litter on a 50 foot section of Wood River Creek

- increase in the use of litter bags in automobiles

- increase in the purchase of soft drinks in returnable containers

- increase in classroom use of films and filmstrips on environmental education

- increase in books and magazines relative to environmental problems checked out of school libraries and instructional materials centers

- increase in number of subscriptions to periodicals and other publications relative to environmental education

Students and families of students involved in the project are evaluated on the basis of the above stated objectives. Any different approach that you and/or your students might conceive that will further develop these objectives will be most welcome at the Project Center.

A concept-activity file is constantly being formulated at the Project Center to supplement the resource unit. Additional activities should be evaluated and used to increase motivation and interest depending on the students' background.

The concepts as stated in the original proposal are further stated in the field trip section. These concepts are primarily concerned with the water unit. Additional concepts should be developed to meet the needs of the individual teacher and students at the appropriate grade level.

Behavioral objectives are necessary to devise a method of evaluation and proper instruction. The following behavioral objectives are listed as a basis to follow in the teaching of the water unit. Additional objectives should be devised by the teacher as they apply to the individual needs of the students.

1. Students will identify sources of water pollution by constructing a list.

2. Students will identify types of water pollution from their homes by completing a chart at home.

3. Students will show the effect of sewage on streams by completing a diagram.

4. Students will construct working models of the different methods of treating wastewater.

5. Students will assume different roles while playing a simulation game to illustrate the social complexity of pollution problems.

6. Students will use available resource materials on water and its use and misuse.

7. Students will develop a "feeling of ownership" toward water as a natural resource.

8. Students will write to local, state, and federal governments urging passing of anti-pollution laws or to report violation of existing laws.

A pre-test and a post-test must be given to each student. Included in the teacher's packet of supplementary materials is the student test to be duplicated and distributed to each student. The teacher's answer sheet is included in this guide. After completion of the pre- and post-test, please grade and provide the Project Center with the test results. We would prefer the percentage gain or loss for the entire class. Provide this necessary information by completing the teacher evaluation form.

The teacher's manual includes the actual student guide plus guidelines for the teacher to use while instructing students. Actions 5 and 6 are for your use in conducting field trips and determining what resources you want to use.

Not included in the teacher's manual are the transparency masters and the charts/forms for student use. These items are included in the teacher packet of supplementary materials. This arrangement will allow you to make multiple copies to distribute to your students. You are invited to obtain a teacher packet on a loan basis from the Title III Environmental Eduation Project Center. Our telephone number is 618-786-3313.

ENVIRONMENTAL IDEAS

FOR THE STUDENT

-Water-

Teacher's Answer Key

Grade the student responses using the following key.

TRUE OR FALSE QUESTIONS. PLACE A T OR F TO THE LEFT OF THE QUESTION.

__T__ 1. Everyone has the responsibility for conserving the water around him.

__T__ 2. Diseases are caused and spread by poor disposal practices.

__T__ 3. Raw sewage is dangerous to plants and animals.

__F__ 4. Everyone's waste is processed by a sewage plant.

__F__ 5. All pollutants can be removed at a sewage plant.

__T__ 6. Animals that live in farmyard lots can pollute streams and rivers.

__F__ 7. Farmyard lots should drain directly into a stream.

__T__ 8. Phosphates from detergents and nitrogen from fertilizers are food for aquatic plants.

MULTIPLE CHOICE QUESTIONS. PLACE THE LETTER OF THE BEST ANSWER IN THE SPACE TO THE LEFT OF THE QUESTION.

__d__ 9. Water pollution comes from:

a. industries
b. cities
c. farms
d. all of the above.

__d__ 10. Sewage is waste water that leaves your house through sewer pipes. Sewage contains:

a. organic wastes
b. phosphates
c. bacteria
d. all of the above.

d 11. A sewage plant is a:

a. living plant
b. dead plant
c. place where people live
d. place where most pollutants are removed from the water.

a 12. The solid material that is removed at a sewage plant can be used for:

a. fertilizer
b. animal food
c. roads
d. buildings.

b 13. Animal waste should be spread on:

a. hillsides
b. level land
c. along ponds
d. in creek beds.

b 14. Livestock should be watered by:

a. letting them walk out into the water and drink
b. pumping water into livestock watering tanks
c. letting them stand along the edges of streams and ponds and drink.

c 15. A sewage lagoon is a:

a. river
b. stream
c. large pond
d. highway.

b 16. A sewage lagoon is used for:

a. fishing
b. sewage digestion
c. supplying drinking water
d. recreation.

c 17. The sewage in a lagoon is treated by:

a. cattle
b. birds
c. microscopic organisms
d. fire.

c 18. A sewage lagoon when functioning properly:

a. is ugly and stinky
b. has a lot or raw sewage floating around on top
c. gives off very little odor
d. is harmful to be around.

b 19. Septic tanks are used mostly in:

a. large cities
b. rural areas
c. airplanes
d. trains

c 20. The effluent from a septic tank should:

a. run directly into a stream
b. never leave the septic tank
c. pass through a bed of rock and sand and then seep into the soil.

ENVIRONMENT

Idea 3
Water

ENVIRONMENTAL IDEAS FOR THE STUDENT

This guide to environmental ideas is written to provide a better understanding of some of the environmental problems you will face in the future. It is also written in such a way that you will be able to make your own value decisions about what has to be done to maintain and improve the world in which we all live. The interest that you have is directly related to the amount of involvement that you give in the solution to the problems of our surroundings.

PLEASE DO NOT MARK IN THIS BOOKLET. OTHER STUDENTS WILL WANT TO USE IT WHEN YOU ARE FINISHED.

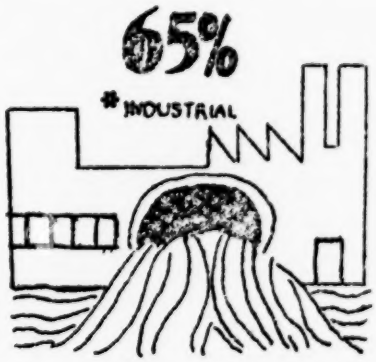
ENVIRONMENT

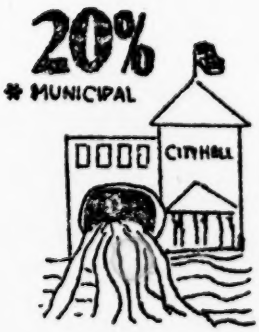
Idea 3
Water

Action 1

Water, Water Everywhere, But Not A Drop To Drink

Industrial, agricultural, and municipal waste material contribute to the pollution of our water supplies. Learning about pollution problems is very important because we need to understand how complex the problem is. To begin, let's find out: <u>Where Does It All Come From</u>?





*National Wildlife Federation, E.Q. Index

A. The Trouble With Water is People

Pollution comes from all sources where people are involved. Industries, cities, and rural environments are the major sources of water pollution. Let's look at the problem.

INDUSTRY - 65%

Every man, woman, and child demands cheap, easy, and convenient goods and services. Because of this demand, industries produce these goods and services. To operate, industry must have water to cool their machinery, to dissolve chemicals, and to carry away their wastes. Name some waste materials from industrial plants in your city or county. List four major categories in which all industrial wastes can be put.

MUNICIPAL - 20%

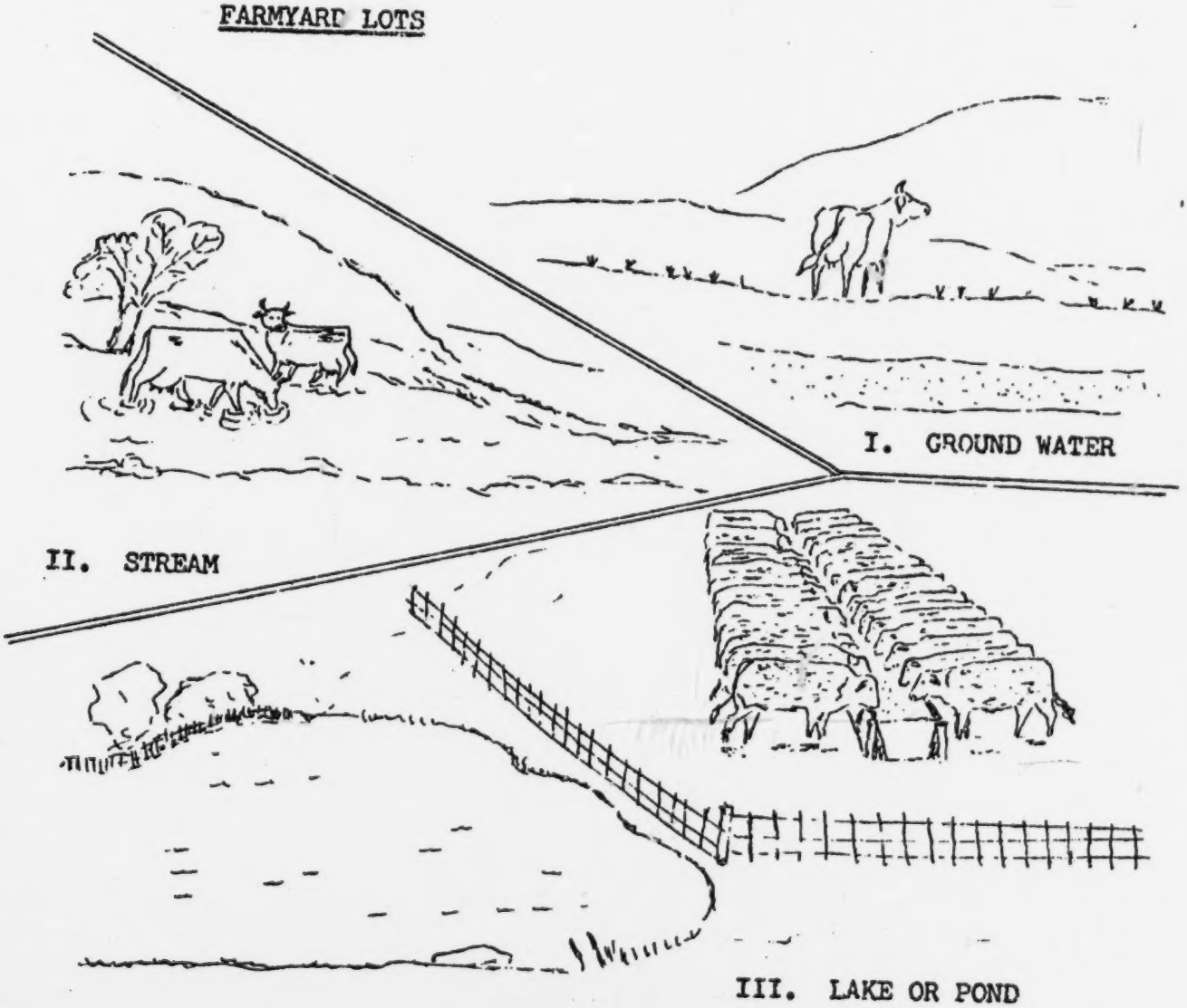
Cities take care of the waste material from most of the homes within the city limits. And the home is the source of much of the pollution of our waters. To understand the problem, we must look at the waste products from our homes. Your teacher will give you a chart to be completed by you at home. Estimate how many gallons of water you use each day, and list the types of waste materials from each use of water. Discuss your results in class.

"Do you really want me to get in there and pollute all that nice clean water?"

AGRICULTURAL - 15%

People need food. People want food that they like the best. Therefore, people raise cows for steaks, chickens for drumsticks, pigs for bacon, sheep for lamb chops, corn for cornbread, and wheat for bread.

Why is this a problem? Let's take cattle for example. If a hundred head of cattle are grazing on the side of a hill with a small stream at the bottom of the hill, where will the animal waste products go when it rains? To examine the problem, look at the three diagrams below. As a class discuss what happens to the waste material during a heavy rain.



B. A Bloom That Isn't Pretty!

Sewage causes water pollution. It is any waste material that leaves your house through drains and sewer pipes. Sewage contains:

ORGANIC MATERIALS
(human waste)
PHOSPHATE DETERGENTS
(plant food)
BACTERIA
(germs)
NITROGEN
(plant food)

If this material goes into a water supply, green plants will grow more than they should. Tiny green plants (algae) will make the water look like pea soup or big mats of slimy green plants will float on the water. The pea soup appearance is called an algae bloom. This is a bloom that isn't pretty!

What is wrong with this bloom? Many things are wrong.

The Kinds of Animals Change
The Number of Animals Decrease
No More Recreation Use
Drinking Water Tastes And Smells

Let's look at a stream that is being polluted by sewage. Your teacher will give you a diagram of a stream. Another diagram will have animals that live in the stream. Some you will know and some will not be familiar to you. Some animals can live in highly polluted water. Other animals must have clean water to survive. Cut out the animal pictures and paste them in the stream where you think they belong. When everyone is finished, discuss your results in class.

TEACHER'S GUIDE

ACTION I

According to the National Wildlife Federation, there are five categories of water pollutants, (1) chemical, (2) sewage, (3) thermal, (4) silt, and (5) crud (trash). Almost every water supply in the United States is polluted to a certain degree. By far the most polluted, by public opinion, is Lake Erie. This is due to the heavy industrial and municipal areas surrounding Lake Erie. Also Lake Erie is the shallowest of the Great Lakes.

Part A. Waste materials from industrial plants might include: sewage, chemicals, heated water, and solid particles. Silt is not a major problem of industry. The tremendous use of water for operational needs is greater than the hydrologic cycle can replace. Students are unable to really get involved in industrial problems, other than learn about the problems.

The following chart contains the suggested responses from the student survey. The chart to be completed is found in the Packet of Supplementary Materials. Make multiple copies, one for each student. Also a transparency can be made from the original chart and used to write the student responses during class discussion.

A CLOSER LOOK AT HOME WATER USE

CONSUMPTION OF WATER IN THE CONTEMPORARY U.S. HOUSEHOLD		
Use	Waste Material	Amount gallons per person per day
Flushing toilets	Raw Sewage, nitrogen, bacteria	20.5
Washing and bathing	Dirt, fats from soap	18.5
Kitchen use	Food wastes, detergents	3.0
Drinking water	None	2.5
Washing clothes	Detergents, dirt	2.0
General household cleansing	Chemicals, detergents, dirt	1.5
Watering the garden	Possible pesticides	1.5
Washing the car	Dirt	0.5
One faucet drip One toilet bowl leak		12.0 60.0

New York, John Wiley & Sons, 1966, Chapter V, pp. 13-15 and City of New York Dept. of Water Supply, Div. of Water Conservation, unpublished data, 1967.

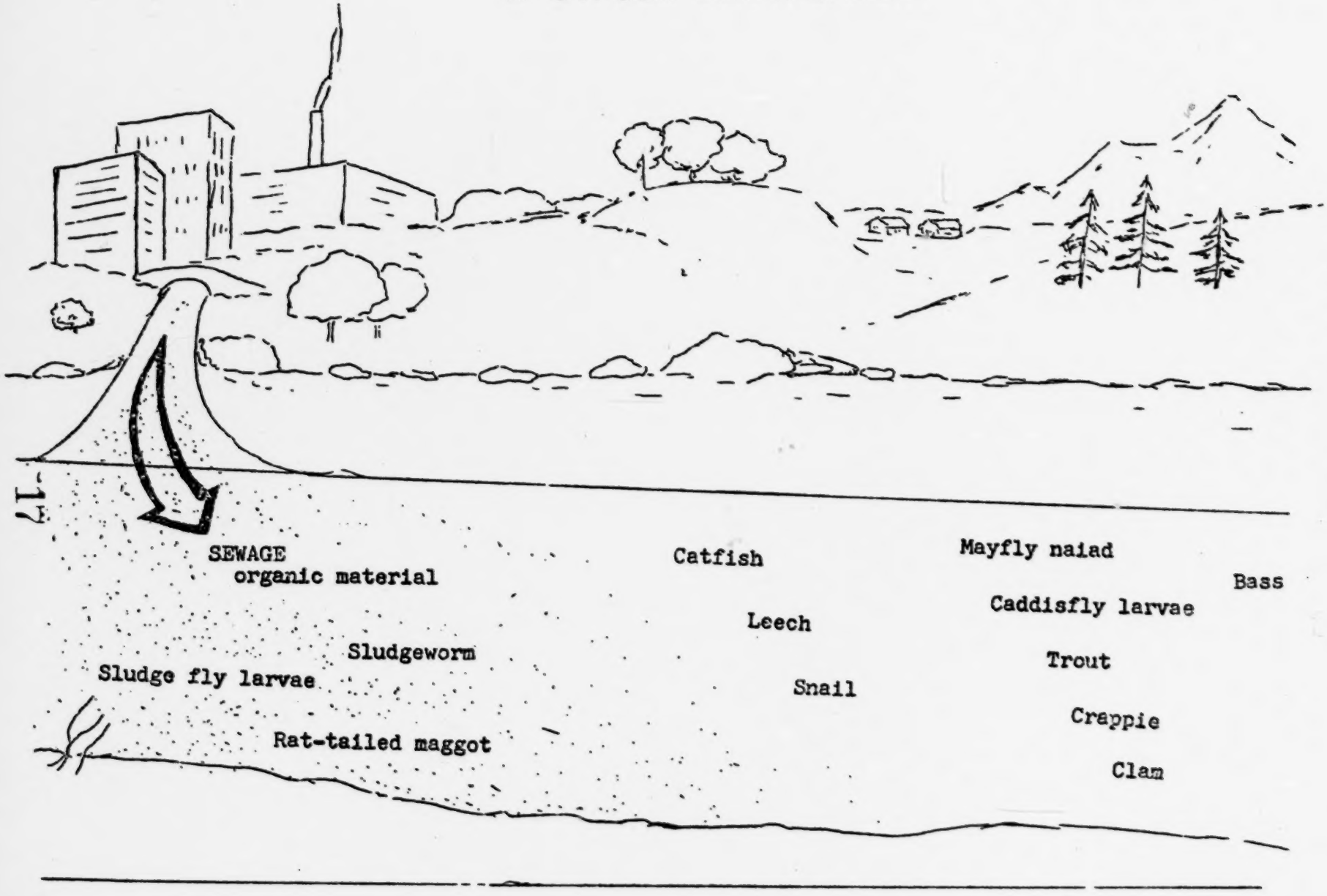
The major problems of agricultural water pollution are: (1) the loss of topsoil through erosion which results in siltation, (2) the runoff from feedlots which carry animal sewage into our water supplies, (3) the heavy use of fertilizers which end up in our water supplies, and (4) pesticide runoff. To understand just one of the problems, discuss the diagrams of the cattle feedlots with your class. The suggested responses should indicate that waste materials will run-off the land into the nearest water supply. Also the waste material will travel through the soil into the ground water supply. This method will remove some impurities as it travels through the soil.

Part B: You can illustrate the pea soup appearance (the algae bloom) by collecting some pond water and leaving it in a warm, sunny location. With few animals, the algae will multiply extensively.

Sewage causes a decrease in the amount of oxygen available. This is due to the heavy demand for oxygen by organisms that decompose the organic waste. The animal population decreases from the lack of oxygen. The following diagram gives the basic animal life in the sewage effluent area and the clean water area.

You can give your students a first-hand experience to observe, test, and record valuable information by taking a field trip to compare a rural stream environment with an industrial stream environment.

A Stream Environment



ENVIRONMENT Idea 3 Water

Action 2

Our Streams Are "Wasting" Away

At one time, most streams were clean and full of life. What little waste entered these waters was taken care of by nature's own waste disposal system.

As man settled the land and built his factories and cities, more wastes were added to these streams. This changed the clean streams to open sewers of human, agricultural and industrial wastes. Now we must make an effort to improve the condition of our streams.

A. What's the Best Way?

To improve the quality of our streams, we must prevent great amounts of waste from entering our water supplies. Is the waste from your home treated before going into a water supply? The waste from your home will go directly to one of the following places:

1. a stream, lake, or drainage ditch;
2. a septic tank;
3. a lagoon; or
4. a municipal treatment plant.

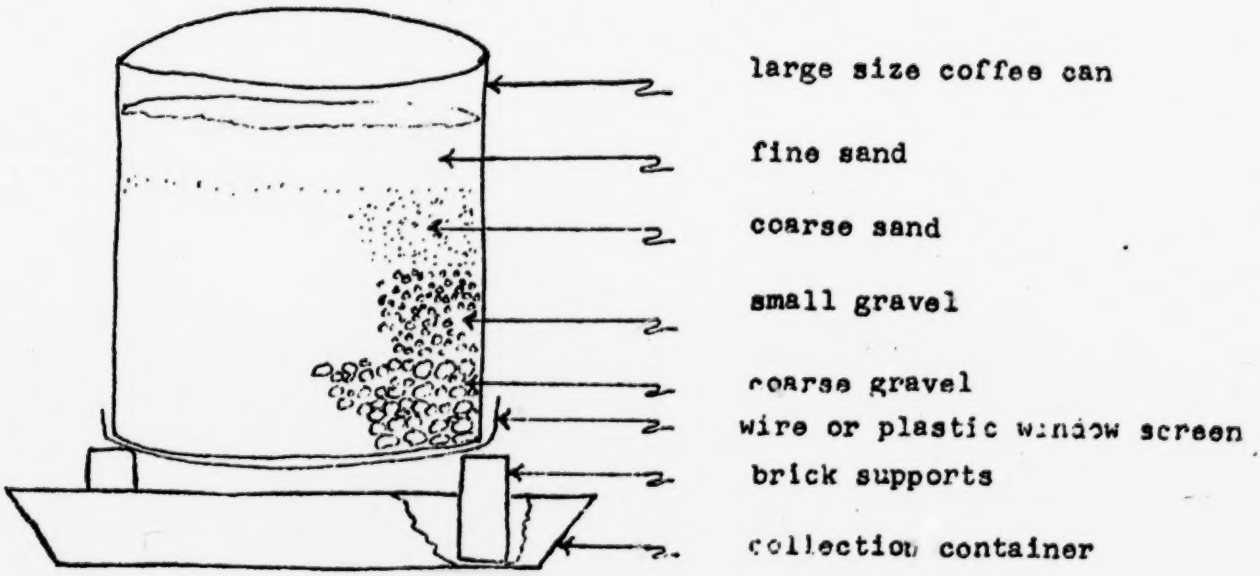
Of course, the worst method is number one, the waste going directly into a stream. This should be corrected by providing some type of treatment.

SEPTIC TANK

A septic tank is usually a large tank, underground, in which a family disposes its waste material. The solid material settles to the bottom. The material that does not settle is partly digested by bacteria. This type of treatment is called primary treatment.

SAND BED FILTER

An extension of the septic tank is the sand bed filter. Water leaving a septic tank is cleaned by moving through different layers of soil and sand. Let's observe how this works by constructing a sand bed filter.



Pour dirty water; such as dish water, into the top of the cylinder. Collect the water that passes through the filter. Is the water clean? Is there anything left in the water that is too small to see? Could you drink this water? Do you have to know the type of soil in your area if this method is going to be effective? Does your family treat the waste material by the septic tank method?

SEWAGE LAGOON

A lagoon is very similar to a septic tank, except that it is large like a pond and collects waste water from many families. Since the lagoon is like a septic tank, explain how the lagoon cleans the waste water. What would happen if too many homes were dumping their waste in the lagoon? Can this lagoon be used for many years? Are there any lagoons in your area? If so, how many and are they operating properly?

MUNICIPAL TREATMENT PLANT

Some treatment plants have only primary treatment. The waste water is allowed to set until the solid material settles out. However, some sewage remains in the water that flows into a stream. Primary treatment removes only 35% of the sewage. Secondary treatment removes about 85% of the sewage. More municipal plants are building secondary treatment facilities. Let's look at both types of treatment.

PRIMARY TREATMENT

Follow the steps below to find out how primary treatment works.

STEP 1

FILL A GLASS JAR WITH WATER AND A HANDFUL OF DIRT

STEP 2

PLACE THE LID ON THE JAR AND SHAKE

STEP 3

LET THE JAR SIT ON A SHELF FOR SEVERAL HOURS

STEP 4

WITHOUT DISTURBING THE JAR, OBSERVE WHAT HAPPENED TO THE DIRT

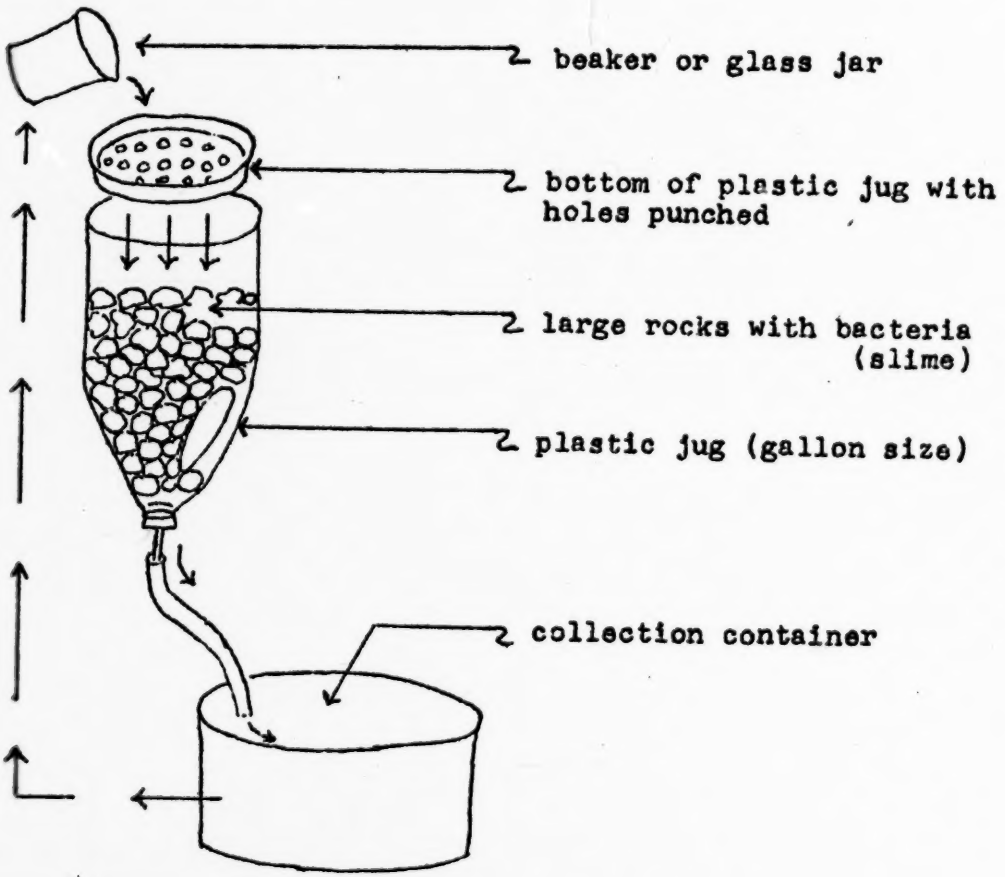
STEP 5

CAREFULLY POUR OFF THE WATER INTO A CLEAN GLASS JAR

Is the water clean? Are there any small particles that you cannot see in the water? Would you be able to drink this water? Does your community have primary treatment?

SECONDARY TREATMENT

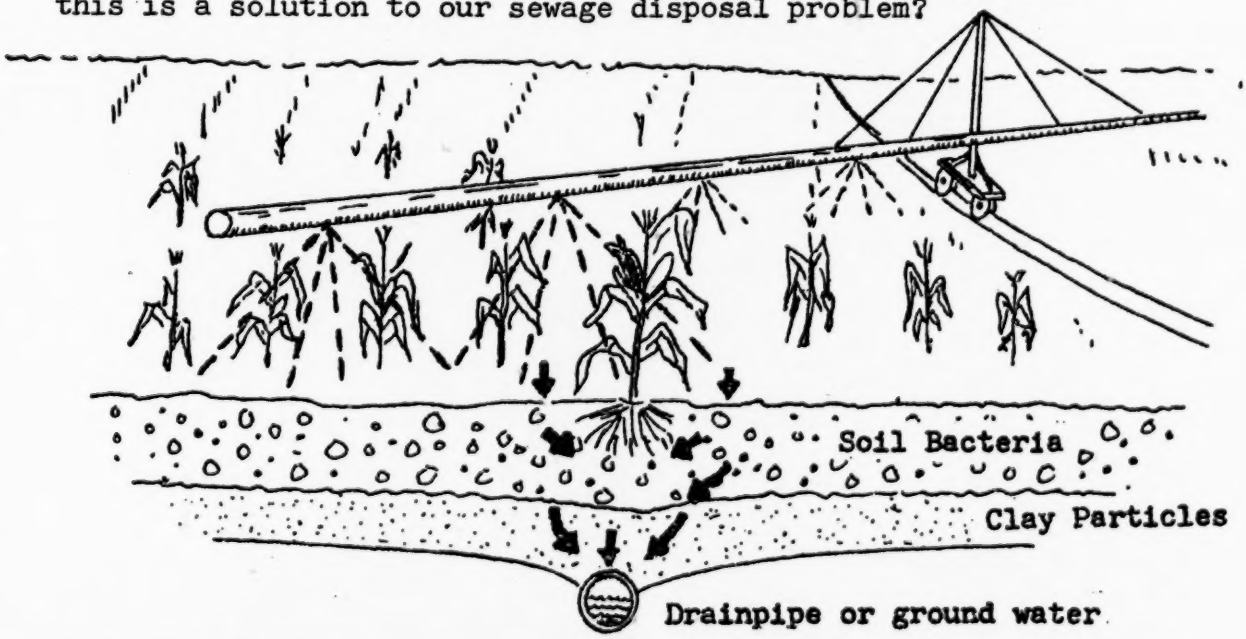
One example of secondary treatment is the trickling filter. Waste water containing sewage can be cleaned by passing through this trickling filter. This type of filter has large rocks with tiny animals and bacteria. These living things digest the sewage as it flows over the rocks. This makes the water cleaner. Your teacher may want to show you how this works by building a model like the diagram below, or discussing the diagram in class.


beaker or glass jar
bottom of plastic jug with holes punched
large rocks with bacteria (slime)
plastic jug (gallon size)
collection container

The water you choose to use for the experiment can be dish water, stream water that you know is polluted, or other waste water. CAUTION - always wash hands after using the water. Pour the waste water over the rocks. Collect the water that goes through the rocks and pour over the rocks again. Keep doing this until there is a slime layer on the rocks. Would you drink the clean water? Does your community have secondary treatment? Is secondary treatment better than primary treatment? Why or why not?

ANIMAL CRACKER
EXCUSE, ME. THIS WATER ISN'T POLLUTED OR ANYTHING, IS IT?
HEY, KIDS, I TOLD YOU JUST TO WADE UP TO YOUR ANKLES! AND KEEP YOUR MOUTHS CLOSED!
...I'M SORRY... WHAT WAS THE QUESTION?
NEVER MIND.

You can see how some waste water is cleaned before going into a stream. But, is this the best way? Why not spread the treated waste water over fields where crops grow? One city in Michigan is doing this. They stopped dumping their waste water in a stream, put it in a large pond, disinfected it, and sprayed it on farm crops. As the waste water goes through the soil, it is cleaned. Eventually this water becomes part of the ground water supply. Do you think that this is a solution to our sewage disposal problem?

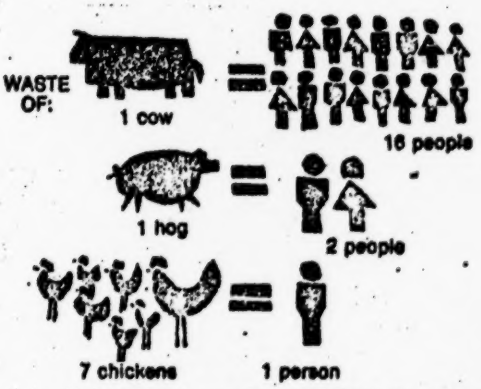


Soil can clean waste water. Bacteria in the upper layer of soil break down the waste chemicals into minerals that plants can use. The lower clay area removes other wastes, including viruses.

B. A Special Problem With Farmers

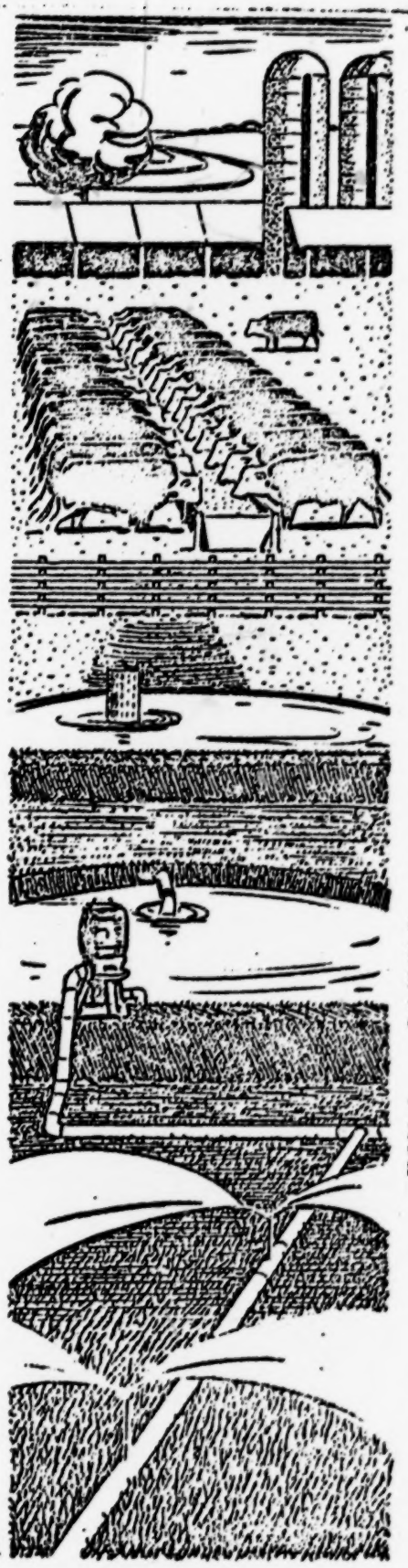
One of the major problems in agriculture is the runoff from feedlots. A dangerous substance that empties into a nearby water supply is the animal waste materials. Let's look at the problem in more detail.

Look at the great amount of wastes:



National Wildlife Federation, E.Q. Index

With this tremendous amount of animal wastes, we must be able to treat the wastes before going into a stream. One way is to build a sewage lagoon. From what you know about a sewage lagoon, what problems do you see about using this treatment? Another way to treat this animal waste is shown in the diagram on the right. By looking at the diagram, can you explain what this farmer is doing?



Journal of Soil and Water Conservation, March-April, 1971

C. Clean Clothes; Clogged Creeks

BROOM HILDA
I GOT SOME OF THAT NEW NON-POLLUTING ENVIRONMENT-SAVING LAUNDRY SOAP AND IT'S MORE THAN I BARGAINED FOR!
DIDN'T IT WASH YOUR CLOTHES?
OH, IT DID THAT FINE!
BUT IT GREW A TREE IN THE WASHTUB!

Your teacher will divide the class into six groups. Each group will be asked to play a role. The way you think is very important in playing this role.

Here are the groups:

GROUP 1 - HOUSEWIVES THAT BUY PHOSPHATE DETERGENTS

GROUP 2 - HOUSEWIVES THAT BUY SOAP

GROUP 3 - GROCERY STORE OWNER

GROUP 4 - STUDENTS AGAINST POLLUTION

GROUP 5 - THE RIVER

GROUP 6 - FISH IN THE RIVER

THE PROBLEM IS WHETHER HIGH PHOSPHATE DETERGENTS SHOULD OR SHOULD NOT BE USED

Your job is to discuss this problem among your group members. Remember to think the way the role members would think.

Some things you should know about the problem include:

PHOSPHATES MAKE THE CLOTHES CLEANER

PHOSPHATES CAUSE PLANTS IN THE WATER TO GROW

DETERGENTS HAVE BEEN STUDIED FOR YEARS

CONSUMERS WANT GOOD PRODUCTS

UNNECESSARY POLLUTION CREATED

HIGH COST TO REMOVE DURING SEWAGE TREATMENT

TEACHER'S GUIDE

ACTION 2

To emphasize clean streams versus polluted streams, have the students bring in pictures showing the differences. Use magazines, newspapers, photographs, or any available source. Have the students write captions for each picture.

Part A: The best way, of course, is any method that prevents sewage pollutants from entering a water supply.

SEPTIC TANK

A septic tank is an acceptable method of disposing waste water if the conditions are right. The tank must not be overloaded, it must be a distance from a water supply, it must not be located in a condensed population area, and soil must be able to filter the waste water before reaching the ground water supply.

SAND BED FILTER

The construction of the sand bed filter can be a class project or an individual student project. This filter is a good working filter which allows students to actually see water being cleansed. Although the operation of this filter will give you clear water, some chemicals, bacteria, and viruses will pass through and remain in the filtrate. To safeguard against diseases in such a filter, the use of chlorine is a necessity. You could illustrate this by putting several drops of bleach in the filtrate.

The sand bed filter is not practical for a large population.

SEWAGE LAGOON

Lagoons are acceptable only if not overloaded with sewage. It takes time and space for bacteria to react with the sewage to make it less harmful. Lagoons will eventually fill with sludge and become useless as a sewage treatment facility. This makes the sewage lagoon an expensive operation due to the price of land.

MUNICIPAL TREATMENT PLANT

Primary, secondary, and tertiary treatment are explained in an excellent booklet, A Primer on Waste Water Treatment, U.S. Department of the Interior and the Federal Water Pollution Control Administration.

This booklet is available for your use as well as multiple copies for student use through the Environmental Education Project Center. Contact a staff member or call 618-786-3313 to borrow these booklets.

Primary Treatment

The "dirty" water you use in the experiment should become clear with most soil particles settling to the bottom. Discuss the possibility of "hidden" substances in the water which might make the water unsafe to drink. The "hidden" substances could be toxic chemicals, bacteria, and viruses.

Secondary Treatment

The model of a trickling filter can be constructed as a class project or use the diagram for discussion purposes. The layer of slime on the rocks indicates that bacteria are reacting with the sewage (organic matter). Continue to recycle the water to obtain this slime layer. Again, chlorine would have to be added to make the filtrate bacteria free.

The effluent from the waste water treatment plant must be disinfected with chlorine or other bacteria-killing agent. The bacteria in the soil will aid in breaking down the chemicals in the waste water. The clay material aids in the removal of viruses and other impurities. Therefore, the ground water is clean before going into a spring or stream. In addition to cleaning the waste water, this material is beneficial to plants because of the organic matter, nitrogen content, and other fertilizers.

Students can survey the local area to determine the community's various approaches in dealing with sewage and list these ways.

Part B: Several important points should be emphasized. Animals confined to feedlots literally make-up a small community. The wastes from these animals create a tremendous disposal problem. Treating this waste material is an expensive operation.

The diagram should be discussed in detail. The farmer is collecting the sewage running off the feedlot. After several settling operations, the effluent is sprayed on the fields. The fertilizer potential is great because of the valuable organic material and nitrogen wastes. Returning this material to the earth is an important and necessary recycling process. Dried sludge can be used as fertilizer to return valuable nutrients to the soil. Experiment using dried sludge mixed with soil to grow plants. The control would be plants growing in soil without fertilizer.

Part C: The role playing activity is meant to emphasize the complex society in which we live. Living habits, political influence, and ecological processes play a major role in whether phosphate detergents should or should not be used. Allow the students to created additional roles, to research the various areas of interest, and to discuss the various roles assumed. Have students make a display of as many empty detergent boxes as possible. Examine the phosphate level per washload of each detergent. Compile a list to be sent home with the students.

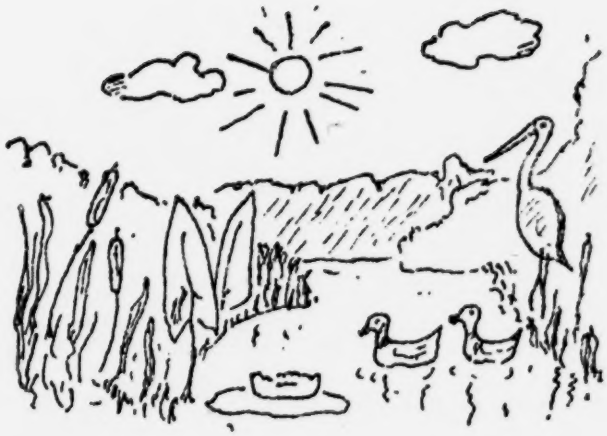
THE BROOK

by Alfred, Lord Tennyson (1855)
interpreted by Arthur Getz (1971) *

I come from haunts of coot and hern,
I make a sudden sally,
And sparkle out among the fern,
To bicker down a valley.
By thirty hills I hurry down,
Or slip between the ridges,
By twenty thorps, a little town,
And half a hundred bridges.
I chatter over stony ways,
In little sharps and trebles,
I bubble into eddying bays,
I babble on the pebbles.
With many a curve my banks I fret
By many a field and fallow,
And many a fairy foreland set
With willow-weed and mallow.
I wind about, and in and out,
With here a blossom sailing,
And here and there a lusty trout,
And here and there a grayling.
And here and there a foamy flake
Upon me, as I travel
With many a silvery waterbreak
Above the golden gravel.
I slip, I slide, I gloom, I glance,
Among my skimming swallows;
I make the netted sunbeam dance
Against my sandy shallows.
And out again I curve and flow
To join the brimming river,
For men may come and men may go,
But I go on forever.

*Audubon, March 1971, Volume 73, Number 2

Verses from THE BROOK
by Alfred, Lord Tennyson (1855)
as interpreted by Arthur Getz (1971)



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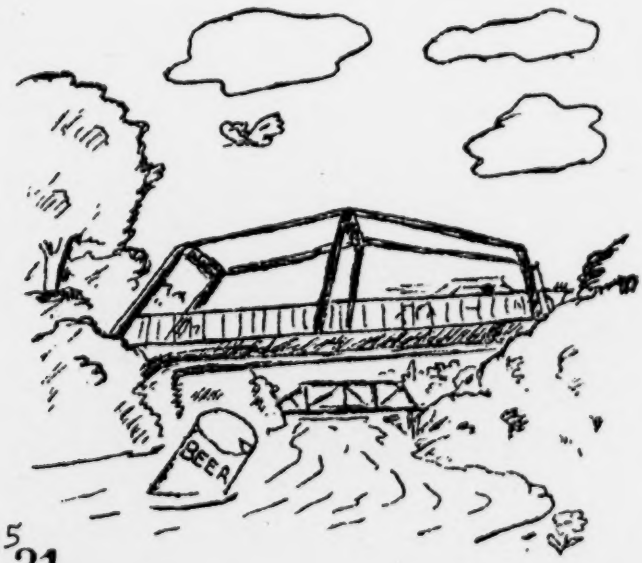

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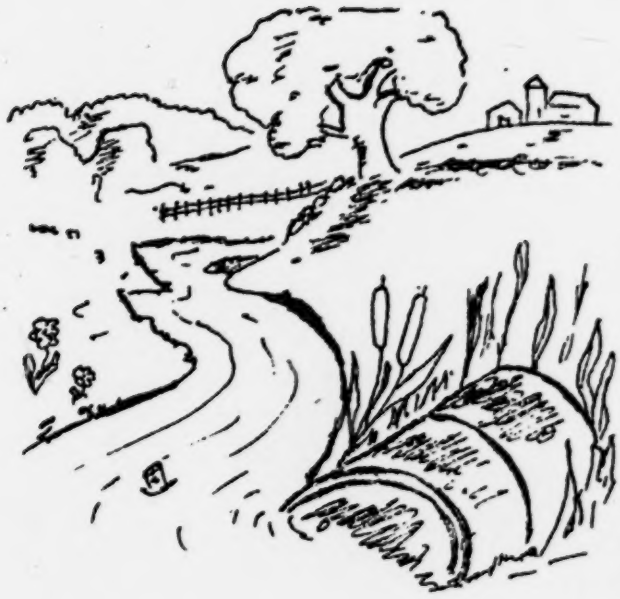

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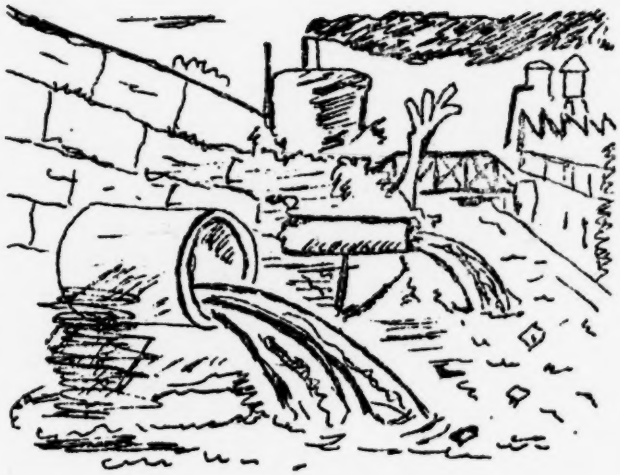

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To join the brimming river,
For men may come and men may go.
But I go on forever.

17

TEACHER'S GUIDE

ACTION 3

The Brook has many connotations and uses with your students. The verses may be used as a take off for other projects and/or writings. Words used throughout the verses need some explanations by some of your better students. Feel free to interpret the verses as you see fit.

The illustrations will help the students visualize some environmental problems concerned with water. Use each illustration as a take-off for discussion in which the students can participate; or have the students make their own illustrations to go along with the verses. The illustrations can be duplicated and distributed to the students for discussion or coloring. The master sheets are found in the packet of supplementary materials.

An additional activity along these lines is the construction of a collage made by pictures brought to class by students. A comparison of a "clean environment" collage with a "polluted environment" collage would be interesting.

There is nothing more dramatic than to show the students an actual situation. A field trip comparing a rural stream environment with an urban stream environment will establish an important awareness of the problems, and their not so easy solutions.

ENVIRONMENT Idea 3 Water

Action 4

"Let's Go on a Field Trip!"

A field trip is to be taken during your teaching of the water unit. The field trip is an integral part of the water unit. It emphasizes the concepts learned, or to be learned by the students. On-the-spot observation is a valuable learning technique especially if the students can get involved. Consult the "Teachers' Policy Handbook" for field trip dress, discipline, and general instructions. Also consult the field trip handbook for specific sites in Jersey, Madison, and Macoupin counties.

A. Raining Dogs and Concepts

Mind filling, factual, see-all field trips have been a traditional approach to the field trip in the past. The question is,"Is the child given any responsibility for learning on his own?" Does he retain more from being spoon-fed facts or from being allowed to learn from his own interest and involvement?

Experience and research indicate that children learn more when they become personally involved in the learning process. This can be achieved by allowing the child to participate in the initial planning of the field trip, and to select a specific investigation on the field trip for which he will be responsible. These specific investigations will be within the bounds of the concepts to be presented on the field trip and in the unit.

The concepts below are only a few of the many that students should come to understand when learning about the environment. Additional concepts may be emphasized at the teachers' discretion. The concepts to be presented are as follows:

1. Water is a natural resource.
2. Man is dependent on the renewable resources for his survival.
3. Everyone has the responsibility for conserving the water around him.
4. Living things are interdependent with each other and with their environment.

5. Change is the only constant of our environment.

6. Diseases are caused and spread by poor disposal practices.

7. There are many kinds of water pollution.

B. Students Plan Field Trip

Allow your students to plan their own field trip. This can be done by guiding the students into areas of interest. An example of how this can be done is outlined below, however this is only a suggestion. The first planning session might go something like this (including key questions to ask).

C. Rural vs. Urban Stream

FIRST SESSION

TEACHER: After studying the Water Unit, how would you like to go on a field trip to learn more about water and water pollution?

STUDENTS: (very excited) Yeh!

TEACHER: All of you will be helping each other to plan what we will be doing at the field trip site. It is very important to make suggestions and listen to other suggestions from your classmates. We will be going to two field sites. One site is a stream in the country. The other site is a stream in the city. What do you think would be important to learn about water and water pollution at these two field trip sites? (Be prepared to list their responses on the chalkboard or overhead projector.)

STUDENTS:

ANIMALS IN THE STREAM	POLLUTION
TEMPERATURE OF THE WATER	ROCKS
COLOR OF THE WATER	LITTER
INDUSTRIES DUMPING WASTES	SNAKES
WHAT THE WHOLE AREA LOOKS LIKE	STREAM USE
TAKE PICTURES OF THE POLLUTION	PRETTY THINGS
WRITE A STORY OR POEM	UGLY THINGS
MAKE A MAP OF THE AREA	FISH
ANIMALS THAT DRINK FROM THE STREAM	FROGS

TEACHER: Let's try to put all these suggestions into four (or five) groups. Then each group will work on specific things to do at the stream sites. (Below is a list of nine possible groups that could be developed from the class list. However, you will probably select only four or five groups.)

GROUP 1 - THE DEVELOPMENT OF A PICTURE STORY USING A SLIDE CAMERA

GROUP 2 - THE AQUATIC LIFE OF A STREAM

GROUP 3 - THE PHYSICAL AND CHEMICAL PROPERTIES OF A STREAM

GROUP 4 - MAPPING THE IMMEDIATE WATERSHED AREA

GROUP 5 - A SURVEY OF ALL SOURCES OF MAN-CAUSED POLLUTION

GROUP 6 - IMPROVING THE ENVIRONMENTAL QUALITY OF AN AREA

GROUP 7 - A SURVEY OF NATURAL ELEMENTS SURROUNDING A STREAM

GROUP 8 - WHY THE STREAM IS HERE AND HOW IT IS USED

GROUP 9 - THE AESTHETIC QUALITIES OF A STREAM

SECOND SESSION

TEACHER: Now that we have our five groups, choose a topic that you would be interested in exploring on the field trip. Now let's get in our groups and choose a leader for your group and a recorder to write down your suggestions. <u>You are to decide what you want to explore and the best way to approach your topic</u>. <u>Also list any equipment you might need</u>. (You will have to work with each group helping them stay on their specific topic. Allow them to explore any approach that the group adopts. Mistakes often enhance the learning process. The following will be a breakdown of <u>possible activities</u> of each group. Many additional questions and activities will come from each group.)

STUDENTS: (Group reactions will range from haphazard to well-organized thoughts. Their interest will be high and frustrations kept to a minimum by the teacher showing interest and help in the development of specific field activities.)

The nine pages that follow are suggested outlines for each of the nine suggested groups on the preceding page. Each category will allow you to guide the students in developing a meaningful field trip experience. It is intended that you allow the students as much freedom in choice as you see worthwhile. Each group should develop enough material for approximately thirty minutes at each stream site.

GROUP I
DEVELOPMENT OF A PICTURE STORY USING A SLIDE CAMERA

EXPLORATION

THE STORY IS GOING TO BE ABOUT_____.

SOME OF THE THINGS THAT MIGHT BE IN OUR STORY ARE:

- CLASSROOM PREPARATION
- BOARDING THE BUS
- OVERALL VIEWS OF THE STREAM ENVIRONMENT
- CLOSE-UP SHOTS OF PLANTS AND ANIMALS IN THE STREAM
- CLASSMATES WORKING IN STREAM
- POLLUTION SOURCES

THE STORY SHOULD TELL PEOPLE:

- HOW OUR WATER BECOMES POLLUTED
- HOW WE LEARNED ABOUT WATER
- WHAT THE STREAM IS USED FOR
- HOW TO SAVE OUR WATER RESOURCE
- EVERYONE IS RESPONSIBLE FOR CONSERVING OUR WATER

APPROACH

WRITE THE SCRIPT

HOW MANY SLIDES CAN WE TAKE?

EXACTLY WHAT PICTURES DO YOU WANT TO TAKE?

WHAT NARRATION WILL GO ALONG WITH THE PICTURES?

WHO WILL TAKE THE PICTURES?

WHO WILL MAKE THE TITLES?

WHO WILL TAKE CARE OF THE EQUIPMENT?

WHO WILL BE RESPONSIBLE FOR DEVELOPING THE SLIDES?

WHO WILL PUT THE STORY TOGETHER?

MATERIALS AND EQUIPMENT

CAMERA(S) - INSTAMATIC, BOX, OR 35 MILLIMETER (mm)

FILM - SLIDE FILM TO FIT THE CAMERA

NOTEBOOK - TO RECORD THE EXPOSURE NUMBER AND CONTENT

PENCILS

POSTERBOARD AND LETTERING SET TO MAKE TITLE SLIDES

ADDITIONAL COMMENTS

AN INTERESTING APPROACH IS THE FILMING OF THE BEGINNING OF A STREAM THROUGH ITS MANY PHASES (AND POLLUTION SOURCES) TO THE MOUTH OF THE STREAM OR RIVER. THIS APPROACH IS SIMILAR TO THE BROOK AS IN ACTION 3 OF THE WATER UNIT, ENVIRONMENTAL IDEAS FOR THE STUDENT

CONCEPT: EVERYONE HAS THE RESPONSIBILITY FOR CONSERVING THE WATER AROUND HIM.

GROUP 2
THE AQUATIC LIFE OF A STREAM

EXPLORATION

WHAT DOES AQUATIC MEAN?
THE ANIMALS THAT LIVE IN THE STREAM
THE PLANTS THAT ARE FOUND IN THE STREAM
COLLECTING PLANTS AND ANIMALS
PRESERVING THE COLLECTION FOR THE CLASSROOM
POLLUTION IN THE STREAM THAT MIGHT KILL THE ANIMALS AND PLANTS?
THE REASON PLANTS AND ANIMALS NEED TO LIVE TOGETHER
LIFE IN THE STREAM TOO SMALL TO SEE WITHOUT A MICROSCOPE

APPROACH

LIST THE ANIMALS AND PLANTS THAT MIGHT BE FOUND IN THE STREAM
COLLECT SAMPLES FROM DIFFERENT PLACES
IDENTIFY PLANTS AND ANIMALS FOUND
COLLECT WATER SAMPLE TO OBSERVE UNDER MICROSCOPE BACK AT SCHOOL
FIND REASONS FOR PLANTS AND ANIMALS LIVING IN ONE ENVIRONMENT AND NOT ANOTHER
WHO WILL RECORD THE TIME, PLACE, SAMPLES, AND LIFE FOUND?
GET MATERIALS AND EQUIPMENT ORGANIZED
WHO IS RESPONSIBLE FOR THE MATERIAL AND EQUIPMENT?

MATERIALS AND EQUIPMENT

DIP NET OR SCREEN TO COLLECT BOTTOM ORGANISMS
A PAN (LIGHT COLOR) TO LOOK AT THE SAMPLES
TWEEZERS
CONTAINERS FOR TAKING SAMPLES BACK TO THE CLASSROOM
PICTURE SHEETS TO IDENTIFY PLANTS AND ANIMALS
MILLIPORE FILTER KITS TO COLLECT MICROSCOPIC ORGANISMS (OPTIONAL, AVAILABLE FROM THE ENVIRONMENTAL EDUCATION CENTER)
WADING BOOTS OR GALOSHES
LABELS
PENCILS

ADDITIONAL COMMENTS

IT IS IMPORTANT THAT THE TOTAL PICTURE IS SEEN BY PUTTING TOGETHER THE AQUATIC LIFE OF A STREAM AND THE PHYSICAL-CHEMICAL PROPERTIES OF THAT SAME STREAM.

CONCEPT: LIVING THINGS ARE INTERDEPENDENT WITH EACH OTHER AND WITH THEIR ENVIRONMENT.

GOLDEN BOOKS OR OTHER RESOURCES SHOULD BE USED TO DETERMINE THE PLANTS AND ANIMALS THAT LIVE IN A STREAM, LAKE, OR POND.

SUCH QUESTIONS AS: WHAT IS THIS ORGANISM? WHY IS IT HERE? HOW IS IT BEING AFFECTED BY ITS PHYSICAL AND BIOLOGICAL ENVIRONMENT? HOW IS IT AFFECTING ITS PHYSICAL AND BIOLOGICAL ENVIRONMENT? SHOULD BE ASKED.

GROUP 3
THE PHYSICAL AND CHEMICAL PROPERTIES OF A STREAM

EXPLORATION

WHAT DO PHYSICAL AND CHEMICAL PROPERTIES MEAN?
DESCRIBE THE "SMELL" OF THE WATER
DOES WATER HAVE COLOR?
IS THE WATER CLOUDY OR HAZY?
HOW FAST IS THE STREAM MOVING?
STREAM BOTTOM: SAND, GRAVEL, OR MUD?
WHAT IS THE TEMPERATURE OF THE WATER?
IS THE WATER ACID?
IS THERE ENOUGH OXYGEN FOR ANIMALS TO LIVE?
ARE THERE ANY DANGEROUS CHEMICALS ENTERING THE STREAM FROM THE SURROUNDING AREA?
OTHER CHARACTERISTICS OF THE STREAM AND ITS SURROUNDINGS
WHY ARE THE PHYSICAL AND CHEMICAL PROPERTIES OF A STREAM IMPORTANT TO KNOW?

APPROACH

ASSIGN JOBS FOR INDIVIDUAL STUDENTS; COLLECTING SAMPLES, RUNNING TESTS, RECORDING INFORMATION, MEASURING STREAM FLOW, TAKING CARE OF EQUIPMENT
OBSERVE COLOR AGAINST A WHITE BACKGROUND
MEASURE STREAM FLOW BY FLOATING OBJECT FROM POINT A FOR 15 SECONDS TO POINT B. MULTIPLY DISTANCE BETWEEN A AND B BY 4 TO GET FEET PER MINUTE.
TEST TEMPERATURE BY PUTTING THERMOMETER SLIGHTLY UNDER WATER, ALSO TAKE THE TEMPERATURE OF THE AIR
USE TESTING EQUIPMENT TO MEASURE ACIDITY OF WATER (PRACTICE IN CLASSROOM BEFORE FIELD TRIP)
OBSERVE SOURCES IN AREA THAT MIGHT CONTRIBUTE TO WATER POLLUTION BY CHEMICALS

USE MILLIPORE KIT TO SHOW SUSPENDED SOLIDS IN DIFFERENT WATER SUPPLIES (SEE STAFF MEMBER FOR INSTRUCTIONS)

MATERIALS AND EQUIPMENT

NOTEBOOKS TO RECORD INFORMATION
PENCILS
COLLECTING JARS
LABELS
WATCH WITH SECOND HAND
pH TEST KIT (AVAILABLE FROM ENVIRONMENTAL EDUCATION CENTER)
WHITE PAPER
THERMOMETER
MILLIPORE KIT (AVAILABLE FROM ENVIRONMENTAL EDUCATION CENTER)

ADDITIONAL COMMENTS

THE PHYSICAL AND CHEMICAL PROPERTIES OF A STREAM WILL DETERMINE WHAT KINDS OF ANIMAL AND PLANT LIFE ARE PRESENT.

CONCEPTS: LIVING THINGS ARE INTERDEPENDENT WITH EACH OTHER AND WITH THEIR ENVIRONMENT. THERE ARE MANY KINDS OF WATER POLLUTION.

GROUP 4
MAPPING THE IMMEDIATE WATERSHED AREA

EXPLORATION

WHAT IS A WATERSHED?
WHY SHOULD WE LEARN ABOUT THE IMMEDIATE WATERSHED AREA?
HOW BIG OF AN AREA SHOULD WE TRY TO MAP?
WHAT IS OUR MAP GOING TO TELL PEOPLE?

APPROACH

PRACTICE MAPPING THE CLASSROOM BEFORE GOING ON FIELD TRIP
MEASURE THE ENTIRE DISTANCE TO BE MAPPED IN THE FIELD
IF THERE ARE FOUR STUDENTS IN EACH GROUP, EACH STUDENT CAN ACT AS A CORNER MARKER AND STILL SKETCH THE MAP
STANDING IN PLACE SKETCH THE MAJOR LANDMARKS OF THE ENTIRE AREA, THEN PUT IN THE DETAILS
BACK IN THE CLASSROOM COMPARE EACH MAP AND MAKE A MASTER COPY
DISCUSS WHY MAPPING IS IMPORTANT IN THE STUDY OF A WATERSHED
HOW IS THE STREAM RELATED TO A WATERSHED?

MATERIALS AND EQUIPMENT

PAPER - PLAIN WHITE OR GRID
HARD SURFACE ON WHICH TO SKETCH, SUCH AS CLIP BOARD
PENCILS
YARD STICK OR STRING FOR MEASUREMENT

ADDITIONAL COMMENTS

DEPENDING ON GRADE LEVEL, MAPPING CAN BE AN EXTENSION OF REGULAR MAPPING ACTIVITIES IN THE CLASSROOM. THE DEGREE OF ACCURACY WILL DEPEND ON THE STUDENT'S EXPERIENCE. HOWEVER, A SIMPLE SKETCH OF THE WATERSHED AREA CAN BE EXTREMELY MEANINGFUL.

CONCEPT: CHANGE IS THE ONLY CONSTANT OF OUR ENVIRONMENT.

GROUP 5
A SURVEY OF ALL SOURCES OF MAN-CAUSED POLLUTION

EXPLORATION

WHAT IS WATER POLLUTION?
WHAT ARE SOME THINGS THAT CAUSE THE WATER TO BE POLLUTED?
HOW CAN YOU BEST RECORD THE SOURCES OF MAN-CAUSED POLLUTION?
HOW ARE THESE SOURCES OF POLLUTION HARMFUL TO LIVING THINGS IN THE ENVIRONMENT?
DOES MAN REALIZE WHAT HE IS DOING?
WHAT ARE THE ALTERNATIVES?

APPROACH

LEARN ABOUT THE SOURCES OF WATER POLLUTION BEFORE THE FIELD TRIP
PREPARE A CHECKLIST OR SIMILAR FORM TO BE USED AT THE FIELD SITE.
ASSIGN RESPONSIBILITIES TO EACH GROUP MEMBER
AFTER RECORDING THE SOURCES, WRITE A SENTENCE EXPLAINING HOW THIS WATER POLLUTION IS HARMFUL TO LIVING THINGS, INCLUDING MAN.
COMPARE THE VISIBLE SIGNS OF WATER POLLUTION AND THE INVISIBLE SIGNS

MATERIALS AND EQUIPMENT

PAPER OR NOTEBOOK TO RECORD INFORMATION
PENCILS
CLIPBOARD OR OTHER HARD WRITING WRITING SURFACE

ADDITIONAL COMMENTS

FIVE GENERAL SOURCES TO EXPLORE CONCERNING WATER POLLUTION ARE:

CHEMICAL
SEWAGE
THERMAL
SILT
CRUD

CONCEPTS: MAN IS DEPENDENT ON THE RENEWABLE RESOURCES FOR HIS SURVIVAL. THERE ARE MANY KINDS OF WATER POLLUTION.

GROUP 6
IMPROVING THE ENVIRONMENTAL QUALITY OF AN AREA

EXPLORATION

WHAT IS ENVIRONMENTAL QUALITY?
WHAT ARE THE PROBLEMS AT THIS STREAM SITE?
HOW CAN THESE PROBLEMS BE SOLVED?
CAN YOU PERSONALLY IMPROVE THE STREAM ENVIRONMENT?
IS THE STREAM AND SURROUNDING ENVIRONMENT WORTH IMPROVING?

APPROACH

READ ABOUT SOME OF THE THINGS THAT COULD IMPROVE THE QUALITY OF THE STREAM
WRITE DOWN ALL THE THINGS THAT COULD BE DONE TO IMPROVE THE QUALITY OF THE STREAM AND THE SURROUNDING AREA
PICK UP LITTER TO IMPROVE THE LOOKS OF THE STREAM
WHERE ARE THE TRASH RECEPTACLES?
IN THE CLASSROOM WRITE A LETTER OR LETTERS TO THE PROPER AUTHORITIES ABOUT YOUR FIELD TRIP OR ABOUT WATER POLLUTION
CONSTRUCT CHECK DAMS

MATERIALS AND EQUIPMENT

NOTEBOOK TO RECORD INFORMATION
PENCILS
CLIPBOARD OR HARD WRITING SURFACE
BOX OR SACKS TO COLLECT LITTER
GLOVES TO PICK UP LITTER
SHOVEL, LOGS, AND STICKS TO CONSTRUCT CHECK DAMS

ADDITIONAL COMMENTS

LITTLE CAN BE DONE TO IMPROVE THE ENVIRONMENTAL QUALITY OF AN AREA BY STUDENTS; SUCH AS ELIMINATION OF SEWAGE AND CHEMICAL WASTE OR DECREASE IN USE OF PESTICIDES AND NITROGEN AND PHOSPHATES.

HOWEVER, LITTER COLLECTION, RESEEDING, TREE PLANTING, AND LETTER WRITING CAN ALL BE GOOD STUDENT ACTIVITIES DEVELOPED ON THE FIELD TRIP OR PLANNED FOR THE FUTURE.

CONCEPT: EVERYONE HAS THE RESPONSIBILITY FOR CONSERVING THE WATER AROUND HIM.

GROUP 7
A SURVEY OF NATURAL ELEMENTS SURROUNDING A STREAM

EXPLORATION

WHAT IS MEANT BY NATURAL ELEMENTS?
WHY SHOULD WE LEARN ABOUT OUR NATURAL SURROUNDINGS?
SHOULD CLIMATE BE CONSIDERED A NATURAL ELEMENT?
HOW DOES WEATHER AFFECT A STREAM ENVIRONMENT?
WHAT DO THE BANKS OF THE STREAM LOOK LIKE?
ARE THERE SIGNS OF ANIMALS THAT VISIT THE STREAM FOR FOOD AND WATER?
WHAT IS THE PLANT LIFE OF THE SURROUNDING AREA?
IS THE AREA MOWED OR LEFT IN A NATURAL CONDITION? ARE WEEDS CONTROLLED?
ARE ANY FOSSILS FOUND IN THIS AREA?

APPROACH

ASSIGN RESPONSIBILITIES TO EACH STUDENT
WRITE DOWN ALL THE NATURAL THINGS SURROUNDING THE STREAM
TAKE THE AIR TEMPERATURE AND RECORD THE CLOUD CONDITION, THE WIND DIRECTION AND SPEED, AND THE TIME OF DAY
TAKE SAMPLES OF NATURAL THINGS WITHOUT HARMING NATURE; FOR EXAMPLE ONE LEAF FROM EACH MAJOR TYPE OF TREE OR SOIL AND STREAM BED SAMPLES FROM ONE AREA
OBSERVE ANY CONTROLS FOR NATURALLY OCCURING THINGS; SUCH AS PESTICIDES, CHANNALIZATION, AND CULTIVATION.

MATERIALS AND EQUIPMENT

NOTEBOOK TO RECORD INFORMATION
PENCILS
THERMOMETER(S)
ADDITIONAL WEATHER EQUIPMENT (OPTIONAL)
THICK MAGAZINE TO PRESS LEAVES COLLECTED OR PLASTIC BAGS TO HOLD LEAVES UNTIL YOUR RETURN TO THE CLASSROOM
PLASTER OF PARIS TO TAKE ANIMAL TRACKS (OPTIONAL)
SOIL SAMPLE BAGS (PLASTIC BREAD SACKS)

ADDITIONAL COMMENTS

MAN IS NOT DOMINATE OVER NATURE, HE IS DEPENDENT ON NATURAL FORCES AND THEREFORE MUST LIVE WITH NATURE. IT IS JUST AS IMPORTANT TO PRESERVE NATURE ON THIS FIELD TRIP AS IT IS TO TAKE SAMPLES OF NATURE TO STUDY.

CONCEPTS: WATER IS A NATURAL RESOURCE. MAN IS DEPENDENT ON THE RENEWABLE RESOURCES FOR HIS SURVIVAL. LIVING THINGS ARE INTERDEPENDENT WITH EACH OTHER AND WITH THEIR ENVIRONMENT.

GROUP 8
WHY THE STREAM IS HERE
AND HOW IT IS USED

EXPLORATION

DEFINITION OF WATERSHED
HOW MANY STREAMS ARE IN OUR AREA?
HOW IMPORTANT ARE THE ONES WE WILL VISIT ON OUR FIELD TRIP?
WHAT WOULD IT BE LIKE IF THE STREAM WERE NOT HERE?
SHOULD THE STREAM BE CHANGED IN ANY WAY?
DEFINITION OF CHANNELIZATION
WHAT HAPPENS TO THE NATURAL THINGS IF THE STREAM IS CHANNELIZED?
ARE THE LIVING THINGS IN THE STREAM OF ANY IMPORTANCE TO THE STREAM?

APPROACH

USING A MAP OF THE FIELD TRIP AREA, FIND OUT HOW MANY STREAMS ARE PRESENT AND WHAT THEY ARE USED FOR.
ON THE FIELD TRIP FIND OUT IF THE STREAM IS NATURAL OR HAS BEEN CHANNELIZED
MAKE A MASTER LIST OF ALL THE THINGS THAT THIS STREAM COULD BE USED FOR
WHAT CHANGES WOULD YOU MAKE TO MAKE MORE USE OF THE STREAM?
WHEN MAKING CHANGES WHAT HARMFUL THINGS WOULD HAPPEN TO THE STREAM?
WHAT NATURAL CHANGES TAKE PLACE AT THIS STREAM SITE?

MATERIALS AND EQUIPMENT

NOTEBOOK TO RECORD INFORMATION
PENCILS
MAP OF AREA TO BE STUDIED

ADDITIONAL COMMENTS

CONCEPT: CHANGE IS THE ONLY CONSTANT OF OUR ENVIRONMENT.

GROUP 9
THE AESTHETIC QUALITIES OF A STREAM

EXPLORATION

WHAT DOES AESTHETIC MEAN?
WHAT DOES QUALITY MEAN?
WHAT PRETTY THINGS ARE FOUND AT THE STREAM SITE?
WHAT UGLY THINGS ARE FOUND AT THE STREAM SITE?
HOW CAN YOU RECORD THE QUALITY OF A STREAM?
HOW CAN YOU EXPRESS YOUR FEELINGS?

APPROACH

WRITE A STORY ABOUT EACH FIELD TRIP SITE
DRAW A PICTURE OF THE SITES
CREATE A POEM
READ STORIES AND POEMS ABOUT NATURE AND STREAMS
LOOK AT PICTURES OF NATURE AND STREAMS
USE YOUR SENSES AT EACH STREAM SITE. LISTEN, TOUCH, SMELL, AND LOOK AT MANY THINGS IN AND AROUND THE STREAM.

MATERIALS AND EQUIPMENT

THE LIST INCLUDES DIFFERENT POSSIBILITIES; CHOOSE THOSE APPROPRIATE:

PENS AND/OR PENCILS
NOTEBOOKS OR WRITING PAPER
CRAYONS AND/OR COLORED PENCILS
LARGE DRAWING SHEETS
LARGE BOARDS FOR SKETCHING
MAGNIFYING LENS

ADDITIONAL COMMENTS

ACTION 3 - THE BROOK MIGHT HELP STUDENTS DECIDE ON THE APPROACH THEY WANT TO USE

CONCEPTS: MAN IS DEPENDENT ON THE RENEWABLE RESOURCES FOR HIS SURVIVAL. CHANGE IS THE ONLY CONSTANT OF OUR ENVIRONMENT.

FINAL SESSION

Organization before the field trip is extremely important. Review the water unit. The following are questions to consider before the field trip date.

1. DOES EACH GROUP KNOW EXACTLY WHAT THEY ARE TO DO ON THE FIELD TRIP?

2. DOES EACH GROUP HAVE A WAY OF RECORDING INFORMATION GATHERED?

3. DOES EACH GROUP HAVE IN THE CLASSROOM ALL THE MATERIAL AND EQUIPMENT NECESSARY FOR THE FIELD TRIP?

4. IS SOMEONE FROM EACH GROUP RESPONSIBLE FOR EQUIPMENT?

5. ARE THE STUDENTS USING THE EQUIPMENT FAMILIAR WITH ITS USE?

6. ARE THE STUDENTS AWARE OF WATER POLLUTION PROBLEMS?

Specific handouts that might help the students on the field trip are found in the teachers packet of supplementary materials.

Stream Survey Sheet

Indicator Organisms

How to Use Equipment

Data Recording Sheets

If the students have developed their own informational handouts, allow their use.

One handout is of particular interest. The Stream Survey Sheet is a composite listing of the biological, chemical, and physical observations of three stream sites. As a teacher, you might use this sheet to compile the data gathered by the students.

STREAM SURVEY SHEET

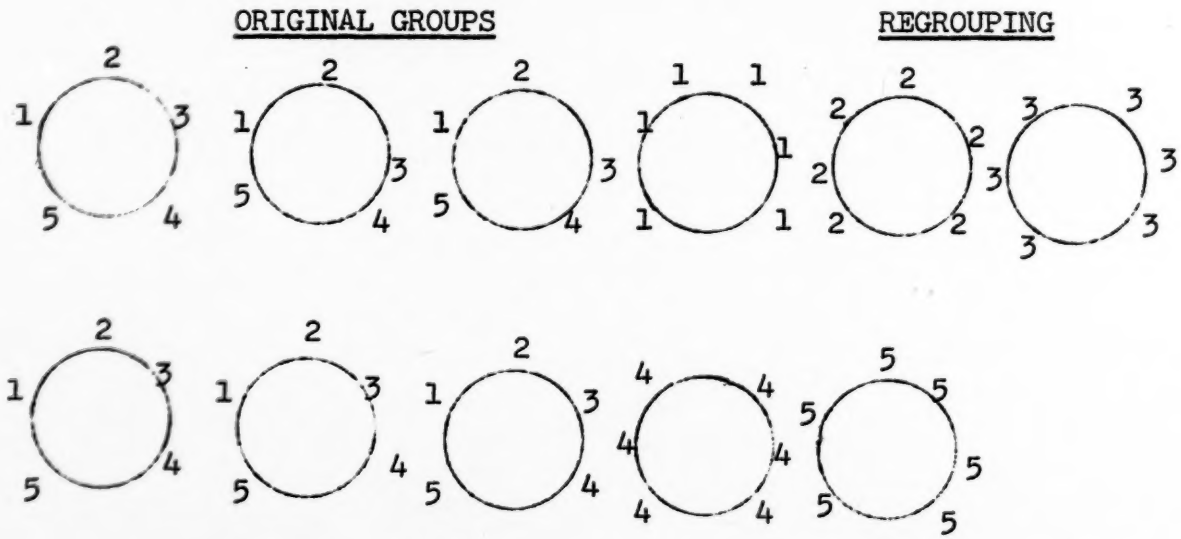
Name of stream_____ Date_____

Characteristics	Upstream	Middle	Downstream
PHYSICAL			
Average width and depth			
Velocity			
Color			
Turbidity			
Air temperature			
Water temperature			
Sky (clear, partly cloudy, or cloudy)			
Stream bed			
Stream banks			
Shade			
Watershed (hilly, rolling, flat, swampy, wooded, open, cultivated, uncultivated)			
Water level (low, normal, high)			
Barriers (type, location, height)			
Springs (location, volume, temperature)			
Tributaries (number & size)			
Accessibility of stream (car or hiking)			
CHEMICAL			
pH			
Dissolved Oxygen (D.O.)			
Nutrients			
Pollution (source, type)			
BIOLOGICAL			
Aquatic vegetation			
Fish food (caddisflies, mayflies, stoneflies, beetles)			
Fish (kinds & numbers)			
Enemies			
Coliform bacteria			

POST SESSION

Just as important as the field trip is the follow through that you provide in the classroom immediately following the trip or within a few days. Following the nine pages of outline forms, you will find a section on tying-it-all-together. This section is extremely important because all the information gathered is useless unless the students can see why it is important to be curious, to discover, and to interpret. The majority of information included is simple relationships. In nature such complex interactions take place that it is difficult to expand without lengthy discussions. A suggested approach with your students is to allow them to dig into books, pamphlets, and articles to further develop the concepts presented.

One way for students to tie-it-all-together is to allow regrouping. Form new groups with one student representative from each original group. As an example use the diagram.



The students in the regrouping diagram should discuss what they did on the field trip and what information was gathered. For example; if the water was acid, green in color, floating crud, no aquatic life, and had a great many pollution sources, the students could very well evaluate the quality of the stream.

TYING-IT-ALL-TOGETHER

PHYSICAL FACTORS

1. TURBIDITY - the degree of clearness will effect the rate of photosynthesis and the aquatic life present. Hold up a jar of stream water and compare with clear tap water. Light penetration is greater with clear water.

2. VELOCITY - the current of a stream increases the amount of oxygen due to the mixing action with the layer of air above the stream. Measure the current by floating an object for 15 seconds. Determine how many feet the object traveled. Multiply your result by four to determine feet per minute.

3. TEMPERATURE - the higher the temperature the less oxygen the water can hold. A thermometer placed through a one-hole cork can be used to determine the temperature of the stream.

4. STREAM BED - gravel, sand, mud, or a combination will have an effect on aquatic life and physical factors of a stream. Increased siltation will cause greater turbidity.

5. STREAM BANKS - the degree of incline will indicate, to some extent, the degree of natural and man-caused erosion. As the amount of water grows, the velocity and turbulence increases; therefore making deeper cuts into the stream bank. Other factors are present; such as vegetation, flood stages, and channelization.

CHEMICAL FACTORS

1. pH - water that is too acid or too alkaline can be dangerous to aquatic life as well as to human health. Litmus paper or chemical reagents can be used to determine the pH. A range of 5-10 is acceptable; whereas the pH of seven is neutral (tap water).

2. DISSOLVED OXYGEN (D.O.) - a necessity for aquatic animals. The D.O. level should be above five to be adequate for fish and other aquatic animals. The test for D.O. is complex, however advanced students could possibly handle it.

3. NUTRIENTS - phosphates and nitrogen will cause plant life to increase. Too much plant life will cause a decrease in D.O. due to less light penetration and the decay process using the available oxygen. The sources of plant nutrients are detergents, sewage, and fertilizers. Chemical tests are more difficult to run and should be handled by advanced students.

4. EFFLUENTS - discharges from factories, municipalities, and individual homes. Effluent standards for the State of Illinois have been proposed and accepted by the Pollution Control Board. Attached is a list of the standards.

BIOLOGICAL FACTORS

1. COLIFORM BACTERIA - found in all warm-blooded animals including man, they can be used to determine if the stream is polluted by sewage. Millipore test kits are available through the Environmental Education Project Center. Instructions are detailed enough for advanced students, but the test might be conducted as a demonstration. Ask a staff member for assistance.

2. ALGAE - tiny green plants which are necessary for animal food. However, too much algae and the wrong type indicates the stream is polluted. Slimy green mats of plant growth tell us there is too much nutrient material in the body of the water.

3. INDICATOR ORGANISMS - invertebrates that are sensitive, slightly tolerant, and tolerant to polluted waters. A picture key is found in the teachers packet of supplementary materials.

An extension of this activity could be the construction of two aquariums. One aquarium would represent a clean stream environment; the other would represent a polluted stream environment. All the materials could be gathered in the field. Gravel, sand, water, plants and animals could be taken to the classroom.

D. Waste Water Treatment

A study of water use and disposal is enhanced by a field trip starting from the school site to the treatment facility to the effluent of the waste water. A further study of different types of treatment will provide the students with a better understanding of the complex problem of waste water treatment. The following page has a sample sheet that could be duplicated and distributed to each student or groups of students during the field trip. This sheet is not all encompassing, but it does provide guidelines for discussion purposes.

During the field trip, additional activities could be performed:

USING TONGS, COLLECT A SAMPLE OF THE STREAM WATER IMMEDIATELY DOWNSTREAM FROM THE DISCHARGE TO OBSERVE THE COLOR AND SEDIMENTATION

USE THE COLLECTED SAMPLES TO RUN COLIFORM BACTERIAL COUNTS USING MILLIPORE EQUIPMENT FROM THE ENVIRONMENTAL EDUCATION CENTER

COMPARE OTHER FACILITIES; SUCH AS LAGOONS, SEPTIC TANKS, AND MUNICIPAL PLANTS WITH PRIMARY OR SECONDARY TREATMENT

OBSERVE AND/OR TEST OTHER WATER SITES WHERE NO TREATMENT IS USED ON THE WASTE WATER

Call 618-786-3313 or contact a staff member from the Environmental Education Project Center for further information on actual field trip sites, materials and equipment available, and other questions you might have.

CAUTION: Handle all waste water carefully. Wash hands immediately after touching. Do not allow students to work with waste water.

WASTE WATER TREATMENT

1 School

WHAT WASTES ARE PRESENT?

_____human wastes
_____detergents (phosphates)
_____food wastes
_____storm sewers
_____playground runoff
_____roof drainage
_____other

2 Influent

IMPORTANT INFORMATION!

color_____
volume_____
number of people served_____
industrial wastes?_____

3 Treatment

LIQUID TREATMENT

debris removed?_____
settling tanks?_____
water tested?_____

SLUDGE TREATMENT

digesters?_____
used as fertilizers_____

4 Effluent

LIQUID LEAVING TREATMENT

color_____
stream, lake, or impoundment?_____
chlorination?_____
phosphates removed?_____

student's name_____site location_____

date_____type of treatment_____

WASTE WATER TREATMENT

(QUESTIONS TO BE ANSWERED)

SEPTIC TANK

1. What is a septic tank used for?
2. How does the raw sewage enter the tank?
3. What happens to the sewage in the tank?
4. What organisms work on the sewage in the tank?
5. How does the effluent leave the tank?
6. What happens to the effluent after it has left the tank?
7. Where should a septic tank be located on the property?
8. If sewage were not treated, what ecological effect would this have on the environment?

LAGOON

1. How many lagoons in the community?
2. What size are the lagoons?
3. How many people are served by the lagoons?
4. What type of material enters the lagoons?
5. What process takes place in the lagoon?
6. What organisms do the work of digesting the waste water?
7. Is this method of treatment acceptable?
8. What are better methods of disposal?
9. Where does the effluent go?

MUNICIPAL PLANT

PRIMARY TREATMENT

1. How does the raw sewage enter the plant?
2. How does the settling tanks function?
3. What happens to the solids after they settle out?
4. What is the purpose of the digester?
5. What takes place in the digester?
6. What organisms are alive in the digester?
7. What provides the heat for the digester?
8. Where does the fuel come from to fire the furnace?
9. Where does the digested sludge go after it has been treated?
10. Can this treated material be used for anything?

SECONDARY TREATMENT

1. Why is the amount of dissolved oxygen critical?
2. What is a trickling filter?
3. What organisms help "eat" the organic matter in the waste water?
4. Is chlorination helpful? In what way?
5. Since it is a known fact that sewage is one of the major causes of water pollution, why are most of the nation's sewage treatment plants inadequate?
6. Does this plant remove phosphates that come from detergents?

ENVIRONMENT Idea 3 Water

Action 5

"A River of Resources"

Often teachers desire additional reading material, visual experiences or discussions to enrich a student's learning experiences. Listed below are materials which may be borrowed from the Environmental Education Project Center, area resource people, and free films.

A. Pools of Knowledge

The Project Staff has accumulated and filed a number of pamphlets, newspaper clippings and magazine articles which are available to teachers for use as resource material. Teachers may borrow for two weeks, articles from any headings in the vertical file. Articles may be obtained by mail, by contacting one of the Project Staff or by calling the Project Center at 618-786-3313. The following headings pertaining to water appear in the file.

Agricultural Pollution
Amphibians
Aquarium
Conservation - Water & Air
Ecology
Ecology - Swamps
Erosion
Estuaries
Fish
Fish - Industry
Gov't Control - Federal - Pesticides
Gov't Control - Federal - Water
Gov't Control - Illinois - Water

Lakes
Natural Resources
Oceanography
Oil Spills
Oxygen - Dissolved
Pollution Control - Costs & Financing
Stream Ecology
Waste Water Treatment
Water - Aquatic Biology
Water
Water - Recycling
Water Cycle
Wildlife - Lakes, Streams & Marshes

Water Pollution
Water Pollution - Control
Water Pollution - Detergents
Water Pollution - Health
Water Pollution - Nitrates
Water Pollution - Oceanic
Water Pollution - Ponds & Lakes
Water Pollution - Siltation & Sedimentation
Water Pollution - Streams & Rivers
Water Pollution - Thermal
Watershed
Water Quality Studies

B. Stepping Stones for Students

The Project Center also has multiple copies of certain resource materials which may be borrowed by a class for use by students or by the teacher as background information. If the teacher desires, and the materials are available, each student may study a copy of a pamphlet for a maximum of two weeks. Such bulk requests should be directed to the Project Staff.

All of the materials listed below were obtained free of charge unless otherwise noted. The teacher or school librarian may obtain permanent copies for his/her building or classroom by directing requests to the following agencies. (Grade levels are indicated by: Primary, Intermediate, Jr. High, and Sr. High).

1. Office of Public Information
   Federal Water Quality Administration
   U.S. Department of the Interior
   Washington, D.C.

   "About Boats and Water Pollution" — I
   "Needed: Clean Water" — I,J,S

2. Office of Public Information
Federal Water Pollution Control Administration
U.S. Department of the Interior
Washington, D.C.

"Showdown for Water"	I,J,S
"A Primer on Waste Water Treatment"	I,J,S
"Mine Acids"	I,J,S
Posters: "Wanted for Murder: Water Pollution"	P,I,J,S
"Stop Water Pollution"	P,I,J,S

3. Manufacturing Chemists Association
1825 Connecticut Ave., NW
Washington, D.C. 20009

"Background Information on Water Pollution Control"	I,J,S
"Everyday Facts About Good Water"	I,J

4. Superintendent of Documents
U.S. Governmental Printing Office
Washington, D.C. 20402

"Clean Water for the 1970's" price: $1.50	J,S
"What You Can Do About Water Pollution" price: 15¢	I,J,S

5. Izaak Walton League of America
1326 Waukegan Road
Glenview, Illinois 60025

"Clean Water - It's Up to You"	I,J,S

6. State of Illinois
Department of Conservation
400 S. Spring Street
Springfield, Illinois

"Digest of Illinois Boat Registration & Safety Act"	J,S

7. Humble Oil and Refining Company
Public Relations Department
Room 4192
P.O. Box 2180
Houston, Texas 77001

"You Can Help Keep Air and Water Clean"	I,J,S

8. American Petroleum Institute
1271 Avenue of the Americas
New York, New York 10020

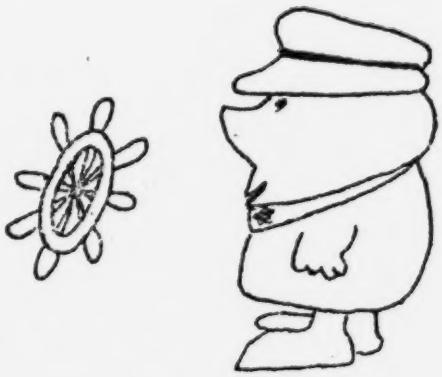
"Conserving Our Waters and Cleaning the Air"	J,S

9. Reprint Editor
The Reader's Digest
Pleasantville, New York 10570

"Crisis on Our Rivers" price: 10/50¢, 50/$2 I,J,S

C. River Pilots

The following is a listing of possible resource people and their titles. You may want to contact one of these resource people about the possibility of speaking to your class. You may also want to contact your local high school concerning students qualified to speak to your class.



JERSEY COUNTY

John Pero, Extension Administrator
Cooperative Extension Service, University of Illinois
405 South State, Jerseyville, Illinois Phone: 618-498-4821

Tom Lamer, District Forester
George Lessig, Fire Warden
Walden Lewis, Area Forester
Illinois Division of Forestry, Department of Conservation
124 West Pearl, Jerseyville, Illinois Phone: 618-498-2828

David Harper, Game and Fish Biologist
Illinois Department of Conservation
142 Robert Street, Jerseyville, Illinois Phone: 618-498-4243

George Threlkeld, District Conservationist
Ray Carter, Soil Conservation Technician
U.S. Dept. of Agriculture
301 South Jefferson, Jerseyville, Illinois Phone: 618-498-3712

Sue Wright, Park Interpreter
Pere Marquette State Park
Grafton, Illinois Phone: 618-786-3718

Dr. Paul Kilburn, Assoc. Professor of Biology
Principia College
Elsah, Illinois Phone: 618-466-2131

Sally Vasse
Audubon Society
Mark Twain Wildlife Refuge Phone: 618-883-2523

MADISON COUNTY

Dr. Harry B. Kirchner, Assoc. Professor of Earth Science
Southern Illinois University
Edwardsville, Illinois Phone: 618-692-3620

Paul Hawkins, Madison County Sanitation Officer
Madison County Court House
Edwardsville, Illinois Phone: 618-656-0913

Dana Grantham, Soil Scientist
Melvern Allen, Conservation Engineer
Dale Sherrard, District Conservationist
U.S. Department of Agriculture
P.O. Box 482, Edwardsville, Illinois Phone: 618-656-4710

Dave Horn, Superintendent of Sanitation
Ralph Wandling, Director of Public Works
Public Works Department, City of Alton
101 East 3rd Street, Alton, Illinois Phone: 618-465-4226

Pride Incorporated
Williams and West Broadway
Alton, Illinois Phone: 618-465-3525

Norman Klueter, Chairman
Madison County Soil and Water District Committee
P.O. Box 482, Edwardsville, Illinois Phone: 618-656-7300

George Sample, Engineer
Shell Oil Corporation
Wood River, Illinois 62095 Phone: 618-254-7371

Joe Nash, Engineer
Laclede Steel Corporation
Alton, Illinois 62002 Phone: 618-462-9731

Ed Sullivan, Engineer
American Oil Corporation
400 S. Main
Wood River, Illinois 62095 Phone: 618-254-7351

The following are members of the Alton Environmental Ecological Control Committee.

Dr. J. Edmund White (Chairman), Department of Chemistry
Southern Illinois University, Edwardsville, Illinois
Phone: 618-692-2042

Cornell C. Brown, employed at Laclede Steel Company
1118 Harrison Street, Alton, Illinois Phone: 618-462-9821

Richard E. Brobst, Chemist at Olin
27 Holly Hill, Alton, Illinois Phone: 618-462-7414

Nick Bono, engineer at WOKZ Radio
3105 Clay Street, Alton, Illinois Phone: 618-462-0181

Francis Hogan, engineer at Owens-Illinois
3116 Burton, Alton, Illinois Phone: 618-462-2365

Mrs. Laraine N. Rowse
807 Grove Street, Alton, Illinois Phone: 618-462-7867

Marvin Mondy, biology teacher
Alton High School, Alton, Illinois Phone: 618-462-0093

Robert Busse, Director of Parks and Recreation - Alton
Rock Springs Park, Alton, Illinois Phone: 618-462-9711

MACOUPIN COUNTY

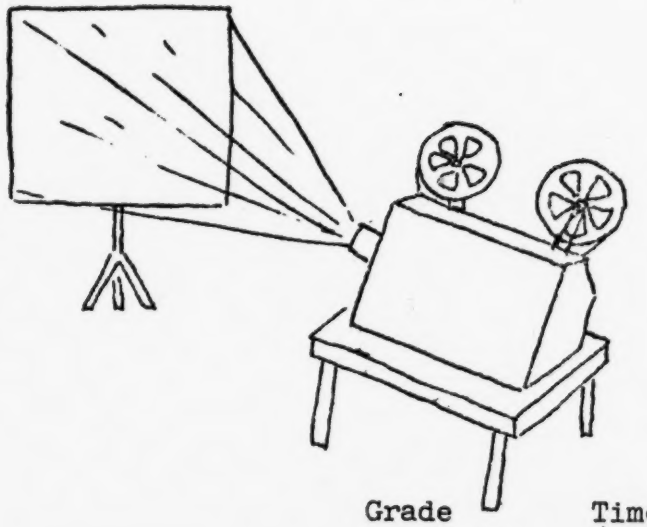
George Caveny, Macoupin County Board of Supervisors
RR, Shipman, Illinois Phone: 618-836-4706

Harley Briscoe, Soil Conservation Service
Harold Landon, Agricultural Stabilization and Conservation Service
805 North Broad Street, Carlinville, Illinois Phone: 217-854-6711

James England, Conservation Officer
Illinois Department of Conservation
RR 2, Carlinville, Illinois Phone: 217-854-6461

Frank Simmermaker, Park Ranger
Illinois Department of Conservation
RR 2, Box 61, Plainview, Illinois Phone: 618-836-4871

D. "Sights and Sounds Downstream"



The following is a listing of films available at the Alton Education Center, 2739 E. Broadway, Alton, Phone: 618-462-1021. All films are in color except those designated by (*) asterisk.

Alton No.	Center No.	Title	Grade Level	Time (min)
	3319	Living Things in a Drop of Water	P	10
	3369	We Explore the Stream	P	11
	3680	Conservation for Beginners	P,I	11
160	3406	How Water Helps Us	P,I	11
328	3687	Water and What It Does	P,I	11
	3713	Water: A First Film	P,I	9¼
248		Your Friend the Water: Clean or Dirty*	P,I	6
238	3336	(The) Water Cycle*	I	11
	3768	Conservation: A Job for Young America	I	19
876		Water Works For Us*	I,J	13
	3544	What Makes Clouds	I,J,S	19
	3800	Problems of Conservation: Water	J,S	16
	3697	(The) Problem With Water is People	J,S,C	30

The following films may be obtained free if a teacher so desires. The films may be borrowed from the sources given below with the only cost being that of return postage. All films are in color except those designated by (*) asterisk.

TITLE OF FILM	SOURCE OF FILM	GRADE LEVEL	TIME (min.)
"Tom Leher Sings Pollution"	The Department of Conservation Film Loan Service 113 State Office Building Springfield, IL 62076 Phone: 618-525-7453	P,I,J,S	3½
"Downstream" (Canoeing Ozark Streams)	Environmental Education Specialist Jefferson National Expansion Memorial 11 N. Fourth Street St. Louis, MO 63102	P,I,J,S	30
"Heritage of Splendor"	Modern Talking Picture Service, Inc. c/o Swank Motion Pictures, Inc. 201 S. Jefferson St. Louis, MO 63103 Phone: 314-534-5211	P	14
"The Beaver"	Film Loan Service, Div. of Educ. Illinois Dept. of Conservation State Office Building, Room 113 400 S. Spring Springfield, IL 62706	P	11
"Mud" (The story of urban erosion and sedimentation)	Environmental Education Specialist Jefferson National Expansion Memorial 11 N. Fourth Street St. Louis, MO 63102	I	28
"The House of Man...Our Changing Environment" (Discussion of changes in man's life and what values he will preserve)	same as above	I,J,S	15

TITLE OF FILM	SOURCE OF FILM	GRADE LEVEL	TIME (min.)
"So Little Time" (The story of endangered waterfowl because of habitat loss)	U.S. Department of Interior Fish and Wildlife Service Bureau of Sport Fisheries and Wildlife Federal Building, Fort Snelling Twin Cities, MN 55111	I,J,S	28
"The River Must Live"	Shell Film Library 450 N. Meridian Street Indianapolis, IN 46204	I,J,S	21
"It's Your Decision- Clean Water"	Associated Sterling Films 512 Burlington Ave. LaGrange, IL 60525	I,J,S	18
"All the Difference"	Modern Talking Picture Service, Inc. Inc. c/o Swank Motion Pictures, Inc. 201 S. Jefferson St. Louis, MO 63103 Phone: 314-534-5211	I,J,S	22